

Differential Evolution: Recent Advances

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Abstract:

Differential Evolution (DE) is one of the most powerful stochastic real-parameter optimization algorithms of current interest. DE operates through similar computational steps as employed by a standard Evolutionary Algorithm (EA). However, unlike traditional EAs, the DE-variants perturb the current-generation population members with the scaled differences of distinct population members. Therefore, no separate probability distribution has to be used for generating the offspring. Since its inception in 1995, DE has drawn the attention of many researchers all over the world resulting in a lot of variants of the basic algorithm with improved performance. This tutorial will begin with a brief overview of the basic concepts related to DE, its algorithmic components and control parameters. It will subsequently discuss some of the significant algorithmic variants of DE for bound constrained single-objective optimization. Recent modifications of the DE family of algorithms for multi-objective, constrained, large-scale, niching and dynamic optimization problems will also be included. The talk will discuss the effects of incorporating *ensemble learning* in DE – a novel concept can be applied to swarm & evolutionary algorithms to solve various kinds of optimization problems. The talk will also discuss proximity and neighborhood based DE to improve the performance of DE on multi-modal landscapes. Theoretical advances made to understand the search mechanism of DE and the effect of its most important control parameters will be discussed. The talk will finally highlight a few problems that pose severe challenge to the state-of-the-art DE algorithms and demand strong research effort from the DE-community in the future.